FORM PTO-1390 (REV 11-2000)	U.S. DEPARTMENT OF COMMERCE PATENT AND TRADEMARK OFFICE	ATTORNEY'S DOCKET NUMBER 36-1485

TRANSMITTAL LETTER TO THE UNITED STATES DESIGNATED/ELECTED OFFICE (DO/EO/US) CONCERNING A FILING UNDER 35 U.S.C. 371

U.S. APPLICATION NO. (If known, see 37 C.F.R. 1.5)

09/936175
Unknown

INTERNATIONAL APPLICATION NO. PCT/GB00/00882	INTERNATIONAL FILING DATE 10 March 2000	PRIORITY DATE CLAIMED 31 March 1999 13 July 1999

TITLE OF INVENTION

METHOD AND APPARATUS FOR AUTOMATED SOFTWARE TESTING

APPLICANT(S) FOR DO/EO/US

WARD et al

Applicant herewith submits to the United States Designated/Elected Office (DO/EO/US) the following items and other information:

1. ☒ This is a **FIRST** submission of items concerning a filing under 35 U.S.C. 371.

2. ☐ This is a **SECOND** or **SUBSEQUENT** submission of items concerning a filing under 35 U.S.C. 371.

3. ☒ This is an express request to begin national examination procedures (35 U.S.C. 371(f)). The submission must include items (5), (6), (9) and (21) indicated below.

4. ☒ The U.S. has been elected by the expiration of 19 months from the priority date (Article 31).

5. A copy of the International Application as filed (35 U.S.C. 371(c)(2)).

   a. ☒ is attached hereto (required only if not communicated by the International Bureau).

   b. ☒ has been communicated by the International Bureau.

   c. ☐ is not required, as the application was filed in the United States Receiving Office (RO/US).

6. ☐ An English language translation of the International Application as filed (35 U.S.C. 371(c)(2)).

   a. ☐ is attached hereto.

   b. ☐ has been previously submitted under 35 U.S.C. 154(d)(4).

7. Amendments to the claims of the International Application under PCT Article 19 (35 U.S.C. 371(c)(3))

   a. ☐ are attached hereto (required only if not communicated by the International Bureau).

   b. ☐ have been communicated by the International Bureau.

   c. ☐ have not been made; however, the time limit for making such amendments has **NOT** expired.

   d. ☐ have not been made and will not be made.

8. ☐ An English language translation of the amendments to the claims under PCT Article 19 (35 U.S.C. 371(c)(3)).

9. ☒ An oath or declaration of the inventor(s) (35 U.S.C. 371(c)(4)).

10. ☐ A English language translation of the annexes of the International Preliminary Examination Report under PCT Article 36 (35 U.S.C. 371(c)(5)).

Items 11 To 20 below concern document(s) or information included:

11. ☐ An Information Disclosure Statement under 37 C.F.R. 1.97 and 1.98.

12. ☒ An assignment document for recording. A separate cover sheet in compliance with 37 C.F.R. 3.28 and 3.31 is included.

13. ☒ A FIRST preliminary amendment.

14. ☐ A SECOND or SUBSEQUENT preliminary amendment.

15. ☐ A substitute specification.

16. ☐ A change of power of attorney and/or address letter.

17. ☐ A computer-readable form of the sequence listing in accordance with PCT Rule 13ter.2 and 35 U.S.C. 1.821-1.825.

18. ☐ A second copy of the published international application under 35 U.S.C. 154(d)(4).

19. ☐ A second copy of the English language translation of the international application under 35 U.S.C. 154(d)(4).

20. ☐ Other items or information.

U.S. APPLICATION NO. (from PTO/Sb/07 or FR 1.5)	INTERNATIONAL APPLICATION NO.	ATTORNEY'S DOCKET NUMBER
09/936175	PCT/GB00/00882	36-1485

21. ☒ The following fees are submitted:

		CALCULATIONS	PTO USE ONLY

BASIC NATIONAL FEE (37 C.F.R. 1.492(a)(1)-(5):

-- Neither international preliminary examination fee (37 C.F.R. 1.482) nor international search fee (37 C.F.R. 1.445(a)(2)) paid to USPTO and International Search Report not prepared by the EPO or JPO $1000.00

-- International preliminary examination fee (37 C.F.R. 1.482) not paid to USPTO but International Search Report prepared by the EPO or JPO...................$860.00

-- International preliminary examination fee (37 C.F.R. 1.482) not paid to USPTO but international search fee (37 C.F.R. 1.445(a)(2)) paid to USPTO.......................$710.00

-- International preliminary examination fee (37 C.F.R. 1.482) paid to USPTO but all claims did not satisfy provisions of PCT Article 33(1)-(4)...............................$690.00

-- International preliminary examination fee (37 C.F.R. 1.482) paid to USPTO and all claims satisfied provisions of PCT Article 33(1)-(4)..$100.00

ENTER APPROPRIATE BASIC FEE AMOUNT =		$ 860.00	
Surcharge of $130.00 for furnishing the oath or declaration later than ☐ 20 ☐ 30 months from the earliest claimed priority date (37 C.F.R. 1.492(e)).		$ 0.00	

CLAIMS	NUMBER FILED		NUMBER EXTRA	RATE			
Total Claims	12	-20 =	0	X	$18.00	$ 0.00	
Independent Claims	2	-3 =	0	X	$80.00	0.00	
MULTIPLE DEPENDENT CLAIMS(S) (if applicable)					$270.00	$ 0.00	
TOTAL OF ABOVE CALCULATIONS =						$ 860.00	

☐ Applicant claims small entity status. See 37 CFR 1.27. The fees indicated above are reduced by 1/2.

		0.00	
SUBTOTAL =		$ 860.00	
Processing fee of $130.00, for furnishing the English Translation later than ☐ 20 ☐ 30 months from the earliest claimed priority date (37 C.F.R. 1.492(f)). +		0.00	
TOTAL NATIONAL FEE =		$ 860.00	
Fee for recording the enclosed assignment (37 C.F.R. 1.21(h)). The assignment must be accompanied by an appropriate cover sheet (37 C.F.R. 3.28, 3.31). **$40.00** per property +		$ 40.00	
Fee for Petition to Revive Unintentionally Abandoned Application ($1240.00 − Small Entity = $620.00)		$ 0.00	
TOTAL FEES ENCLOSED =		$ 900.00	

	Amount to be:		
	refunded	$	
	Charged	$	

a. ☒ A check in the amount of $900.00 to cover the above fees is enclosed.

b. ☐ Please charge my Deposit Account No. 14-1140 in the amount of $_____ to cover the above fees. A duplicate copy of this form is enclosed.

c. ☒ The Commissioner is hereby authorized to charge any additional fees which may be required, or credit any overpayment to Deposit Account Sheet No. 14-1140. A duplicate copy of this form is enclosed.

d. ☒ The entire content of the foreign application(s), referred to in this application is/are hereby incorporated by reference in this application.

NOTE: Where an appropriate time limit under 37 C.F.R. 1.494 or 1.495 has not been met, a petition to revive (37 C.F.R. 1.137(a) or (b)) must be filed and granted to restore the application to pending status.

SEND ALL CORRESPONDENCE TO:

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REGISTRATION NUMBER

September 10, 2001
Date

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re Patent Application of

WARD et al   Atty. Ref.:   **36-1485**

Serial No.   **Unknown**   Group:

National Phase of: **PCT/GB00/00882**
International Filing Date: **10 March 2000**

Filed: **September 10, 2001**   Examiner:

For: **METHOD AND APPARATUS FOR AUTOMATED
       SOFTWARE TESTING**
                  *   *   *   *   *   *   *   *   *   *   *

                                                  September 10, 2001

Assistant Commissioner for Patents
Washington, DC 20231

Sir:

PRELIMINARY AMENDMENT

        Prior to calculation of the filing fee and in order to place the above identified

application in better condition for examination, please amend the claims as follows:

IN THE CLAIMS

        Please substitute the following amended claims for corresponding claims

previously presented. A copy of the amended claims showing current revisions is

attached.

3. (Amended) A method according to Claim 1 in which each element of software is

arranged to capture the results of its testing.

4. (Amended) A method according to Claim 1 further comprising the step of

automatically providing a report on the results of the testing.

5. (Amended) A method according to claim 1 in which the test criteria are defined using a scripting language and said method further comprises the step of parsing the test criteria to convert them into a form for testing against.

8.   A method according to Claim 6 in which each element of software is provided with means for capturing the results of its testing.

9. (Amended) An apparatus according to Claim 6 further comprising means for producing a report of the results of testing an element of software.

10. (Amended) An apparatus according to Claim 6 in which the test criteria are defined using a scripting language and the apparatus further comprises means for parsing the test criteria to convert them into a form for testing against.

REMARKS

Attached hereto is a marked-up version of the changes made to the claims by the current amendment. The attached page is captioned "**Version with markings to show changes made**."

The above amendments are made to place the claims in a more traditional format.

Respectfully submitted,

NIXON & VANDERHYE P.C.

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VERSION WITH MARKINGS TO SHOW CHANGES MADE

3. (Amended) A method according to [Claims 1 or 2] <u>Claim 1</u> in which each element of software is arranged to capture the results of its testing.

4. (Amended) A method according to [any of Claims 1 to 3] <u>Claim 1</u> further comprising the step of automatically providing a report on the results of the testing.

5. (Amended) A method according to [any preceding claim] <u>claim 1</u> in which the test criteria are defined using a scripting language and said method further comprises the step of parsing the test criteria to convert them into a form for testing against.

8.   A method according to Claim 6 [or 7] in which each element of software is provided with means for capturing the results of its testing.

9. (Amended) An apparatus according to [any of Claims 6 to 8] <u>Claim 6</u> further comprising means for producing a report of the results of testing an element of software.

10. (Amended) An apparatus according to [any of Claims 6 to 9] <u>Claim 6</u> in which the test criteria are defined using a scripting language and the apparatus further comprises means for parsing the test criteria to convert them into a form for testing against.

1

Method and Apparatus for Automated Software Testing

The present invention relates to software testing and in particular to unit testing software during its operation. The invention can be applied advantageously, but not

5 exclusively, to software produced using object oriented programming languages such as C++, Corba or Java.

Automated testing of software during its development is known. The tests are designed as part of a software development process and these are then programmed

10 into specialised test tools and executed automatically. Many tools are commercially available to support this type of software development technique.

Software that checks itself during operation is also known and has been developed and applied widely. This may involve checking pre and post-conditions or assertions

15 and looking for exceptions at appropriate points in the software during its normal execution (See "Self Testing Systems" - M Aylett and P Utton, BT Technology Journal 1992).

Known testing systems enable end-to-end tests to be run on operational software

20 systems in order to test out the operation of individual facilities. However, there are currently no testing systems that easily enable low level tests to be run on a fully integrated and operational system. These tests are often termed "unit tests" and are applied directly to one or more individual units of code (e.g. a function, method, module or agent). This is in contrast to end-to-end tests of a system that run from a

25 system or user interface. Unit tests are currently run manually or automatically during development before integration.

According to the present invention there is provided a method of testing an operational integrated software system, said system comprising a plurality of

30 software elements, said method comprising the steps of:

a)   automatically registering each active element of software in a registry;

b) associating a set of test criteria with each registered element of software;

c) selecting an element registered in the registry and testing the element in accordance with the associated set of test criteria; and

5 d) capturing the results of the testing of the element and comparing them to the associated test criteria.

This provides the advantage of enabling unit testing to be carried out on an integrated software system during its operation that allows quick identification of 10 latent or newly introduced faults in the software.

Figure 1 is a schematic representation of a computer loaded with software embodying the present invention;

Figure 2 is a functional block diagram of the program elements that comprise the 15 software indicated in Figure 1;

Figure 3 is a flow diagram illustrating part of the processing of the software shown in Figure 2;

Figures 4a and 4b are tables illustrating the data structures used and created by the program elements shown in Figure 2; and

20 Figure 5 is a flow diagram showing a further part of the processing of the software shown in Figure 2.

Figure 1 illustrates a conventional computer 101 such as a PC, running a conventional operating system 103 such as Windows and having a number of 25 resident application programs 105 such as a word processing program, a network browser and e-mail program or a database management program. The computer 101 also includes a software development application program 107 that enables the user to write and compile new programs and a testing program 109 that enables testing to be carried out on programs. The computer 101 is also connected to a conventional 30 disc storage unit 111 for storing data and programs, a keyboard 113 and mouse 115 for allowing user input and a printer 117 and display unit 119 for providing output from the computer 101. The computer 101 also has access to external networks (not shown) via a network card 121.

In conventional object oriented programming the programs are divided into conceptual sub-units called objects. Each object carries out predetermined functions much in the same way that a sub-routine might in conventional programming. Objects carry out

5   processing of data and may co-operate with other objects to carry out some functions. Such co-operation is carried out via interfaces between the objects called arguments that are provided for passing commands, requests and data between the objects.

10   Each object is categorised into a class of objects. In fact, it is the class of an object that determines the functions and performance of an object. An object itself is an embodiment (or instance) of the class and can be created to carry out its function and then deleted once the function is complete. The creation of an object for a given class is carried out under the control of a constructor algorithm. In addition, the

15   corresponding destructor for each class is arranged to remove the entry when the corresponding object is deleted.

Each object comprises one or more methods. Each method is a subroutine that together with other methods provides the functions of the object itself. Methods may

20   co-operate with other objects to carry out functions/processing on behalf of the method. The methods are also defined by the class of the object as are the arguments of the object.

In summary, objects are functional units of software code whose functions are

25   defined by the class of which a given object is an instance. Objects can have a number of states that change depending on the object's interaction with other objects or data. The combined interaction of the objects that make up a computer program provide the functions of the program itself.

30   With reference to figure 2, the testing program 109 comprises five main components, a tester 201, an object registry 203, a report generator 205, a test criteria store 207 and a parser 209. The tester 201 carries out the testing of each object in the software program under test and passes the results of the tests to the report

generator 205. The object registry 203 provides the tester 201 with a list of the objects that form part of the program at any given time (as noted above, objects may be created and destroyed during the operation of a program). The test criteria store 207 is used to hold the data and/or instructions necessary to test each of the objects

5 registered in the object registry 203. In the present embodiment the data and/or instructions held in the test criteria store 207 are immediately usable by the tester 201. However, in some cases the data may be coded using a scripting language. In this case the parser 209 would be used to convert the data/instruction into a form usable by the tester 201. The functions and interactions of the five main components

10 will be described in further detail below.

Figure 2 also shows a program object 211 undergoing testing by the tester 201. The object 211 is a standard object but has three additional areas of functionality that allow it to interact automatically with the testing program 109. The added

15 functionality is provided in the present embodiment by two special methods 213, 215 added to each class definition used in the program under test and by additions to the functionality of the constructor and destructor algorithms for the program.

With reference to figure 3, the constructor is arranged, on the instantiation of an

20 object for a given class, to create an entry in the object registry 203 for the new object (see step 301 of chart C). Then, at step 303, the constructor enters the identification for the object in its entry in the registry 203 (each object, when it is constructed by the constructor, is assigned a unique identifier). At step 305, the class type of the object is entered in the entry for the object and at step 307 the

25 corresponding class name is entered. After step 307 the registration process is completed and the constructor algorithm ends its processing.

As noted above, when an object is no longer required it is deleted by a destructor algorithm. In the present embodiment, the destructor algorithm is also arranged to

30 carry out the steps shown in chart D of Figure 3. At step 309 the destructor algorithm identifies the entry in the registry 203 that corresponds to the object being deleted and at step 311 removes the entry from the registry 203.

With reference to figure 4a, each class of object has a test criteria file that is entered into the test criteria store 207 when the first object of that class is entered in the object registry 203. The criteria are created during the design and implementation of the computer program under test and their precise construction is dependent on the

5 testing methods being used. In the present embodiment, an entry is made in the store 207 for each class 401. For every class, an entry 403 is made for each method within the class. For each method 403, a definition of the input 405 to the method, the output 407 from the method, the start state 409 of the object when the method is performed and the end state 411 of the object on completion of the method is

10 entered in the store 207.

The operation of the tester 201 will be described now with reference to Figure 5 in which at step 501 the tester 201 awaits a command to commence testing. In the present embodiment the command is given by a user. Once the command has been

15 received then, at step 503, the tester 201 chooses the class of object to be tested from the registry 203. In the present embodiment, the system responds to a user command to commence testing and the chooses a method at random. However, the command or choice of method could be produced randomly, in accordance with a predefined testing plan or in response to requests or events from other objects or

20 programs.

At step 505 the tester 201 uses the first special method 213 to determine the number of methods in the chosen object. The method 213 returns data, as shown in Figure 4b, describing the class of the object 413, identifications 415 of each of the

25 methods in the object and a description 417 of the arguments for each of the method. At step 507, using the class identification returned by the method 213, the tester 201 identifies the appropriate test criteria from the test criteria store 207 and at step 509 runs the chosen method against the identified test criteria.

30 At step 511, the tester 201 uses the second special method 215 to capture the results of the test run on the method. The precise data that is captured is determined by the test criteria and may include the output data from the tested method, the resulting state of the object that the method is a part of and a list of other object or

methods that the chosen method interacted with as a result of the test. At step 513, the test data collected in the previous step is compared to the test criteria and the results of the comparison are passed to the report generator 205 for inclusion in a test report. After step 513, the tester returns to step 501 to await a further test

5 instruction.

The tester program 201 is designed to carry out its testing procedures on a program while the program is in operation. In some operating systems the testing program 201 could be arranged to run as a background process or be arranged to operate

10 when there is a predetermined amount of spare processor resource available.

As will be understood by those skilled in the art, in some systems it may be necessary to include means for preventing changes to the run-time environment being made during the testing of a software element. These may be in the form of run-time

15 test switches that are similar in function to a debug compiler switch. In some systems it may be necessary to include a means to restore the state of any persistent variables (variables that retain state after execution) affected by the tests. This can be performed by taking a copy of the persistent variables before a test and restoring them afterwards.

20

It will also be clear to those skilled in the art that the system under test could distributed in nature. For example, testing could be carried out over a network and units of code distributed across many computers. Also, the testing system can be used by developers during the design and build of a software system or be provided

25 as part of the functionality of programs that are ready for use.

The tester program is preferably written in the same language as the program that it is testing. However, although the embodiment above describes the testing of an object oriented programming language, it will be understood by those skilled in the art

30 that the principles of the invention are also applicable to other programming languages. Other such languages may be modular programming languages (such as Modula-2) or sequential programming languages (such as Pascal). It should also be

understood that the term "object" used in the this description is to be construed broadly so as to cover functions, methods, modules or agents.

As will be understood by those skilled in the art, the tester program 109 can be
5   contained on various transmission and/or storage mediums such as a floppy disc, CD-ROM, or magnetic tape so that the program can be loaded onto one or more general purpose computers or could be downloaded over a computer network using a suitable transmission medium.

10   Unless the context clearly requires otherwise, throughout the description and the claims, the words "comprise", "comprising" and the like are to be construed in an inclusive as opposed to an exclusive or exhaustive sense; that is to say, in the sense of "including, but not limited to".

8

CLAIMS

1.   A method of testing an operational integrated software system, said system comprising a plurality of software elements, said method comprising the steps of:

5

      a)   automatically registering each active element of software in a registry;

      b)   associating a set of test criteria with each registered element of software;

      c)   selecting an element registered in the registry and testing the element

10   in accordance with the associated set of test criteria; and

      d)   capturing the results of the testing of the element and comparing them to the associated test criteria.

2.   A method according to Claim 1 in which each element of software is arranged

15 to automatically register an identification of itself in the registry.

3.   A method according to Claims 1 or 2 in which each element of software is arranged to capture the results of its testing.

20 4.   A method according to any of Claims 1 to 3 further comprising the step of automatically providing a report on the results of the testing.

5.   A method according to any preceding claim in which the test criteria are defined using a scripting language and said method further comprises the step of

25 parsing the test criteria to convert them into a form for testing against.

6.   An apparatus for testing an operational integrated software system, said system comprising a plurality of software elements, said apparatus comprising:

30   a)   means for the automatic registration of each active element of software;

      b)   means for associating a set of test criteria with each registered element of software;

c)   means for selecting a registered element of software and testing the element in accordance with the associated test criteria; and

d)   means for comparing the results of the testing of the element against the associated test criteria.

7.   An apparatus according to Claim 6 in which each element of software is provided with means for automatically registering itself.

8.   A method according to Claim 6 or 7 in which each element of software is provided with means for capturing the results of its testing.

9.   An apparatus according to any of Claims 6 to 8 further comprising means for producing a report of the results of testing an element of software.

10.   An apparatus according to any of Claims 6 to 9 in which the test criteria are defined using a scripting language and the apparatus further comprises means for parsing the test criteria to convert them into a form for testing against.

11.   A data carrier loadable into a computer and carrying instructions for causing the computer to carry out the method according to Claim 1.

12.   A data carrier loadable into a computer and carrying instructions for enabling the computer to provide the apparatus according to Claim 6.

ABSTRACT

Method and Apparatus for Automated Software Testing

A method and apparatus are disclosed for testing software at a low level during its

5 operation. The system comprises a registry 203, a test criteria store 207, a report generator 205 and a tester 201. The systems selects elements of software from a program under test, tests the element against predetermined test criteria and reports the results.

10 Figure (2)

Figure 1

Figure 2

Figure 3

D → Identify entry for object ID (309) → Remove Entry (311) → END

C → Create entry in register (301) → Enter object ID in register | entry (303) → Enter object class type in registry | entry (305) → Enter object class name in register | entry (307) → END
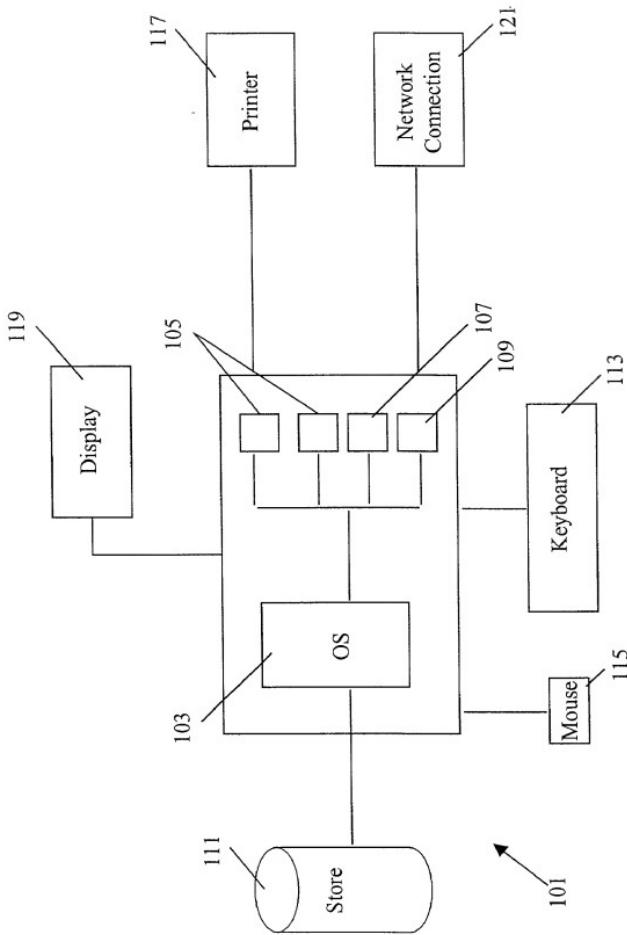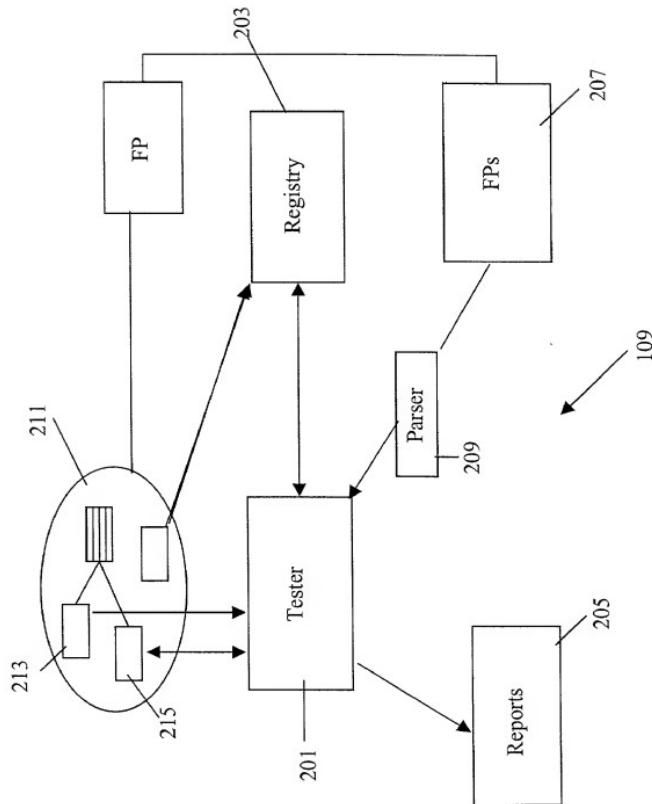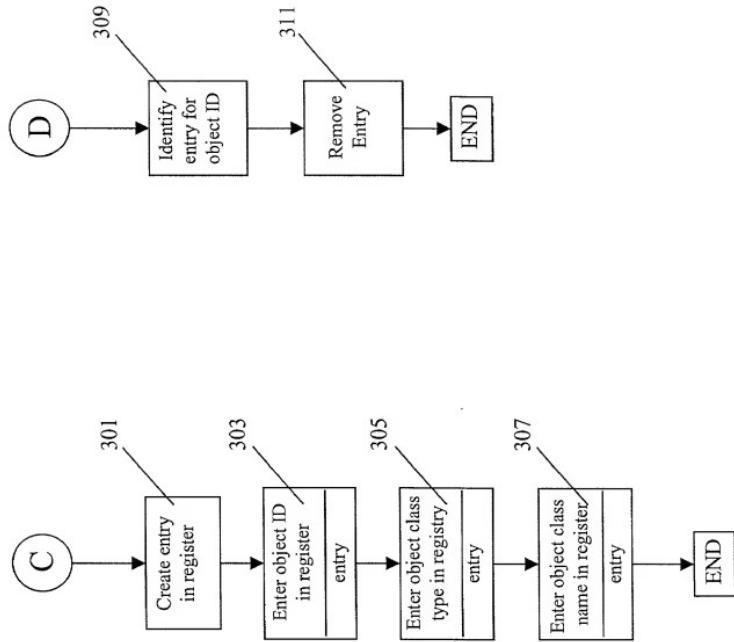
Figure 4a

Class	Method	Input	Output	Start State	End State
401	403	405	407	409	411

Figure 4b

Class	Method ID	Method description (input, output & data types)
413	415	417

Figure 5
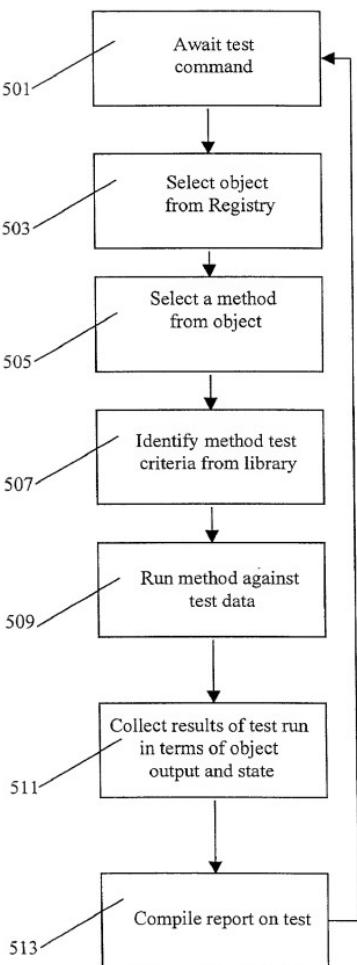
501	Await test command
503	Select object from Registry
505	Select a method from object
507	Identify method test criteria from library
509	Run method against test data
511	Collect results of test run in terms of object output and state
513	Compile report on test

RULE 63 (37 C.F.R. 1.63)
DECLARATION AND POWER OF ATTORNEY
FOR PATENT APPLICATION
IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

As a below named inventor, I hereby declare that my residence, post office address and citizenship are as stated below next to my name, and I believe I am the original, first and sole inventor (if only one name is listed below) or an original, first and joint inventor (if plural names are listed below) of the subject matter which is claimed and for which a patent is sought on the invention entitled:

METHOD AND APPARATUS FOR AUTOMATED SOFTWARE TESTING

the specification of which (check applicable box(es)):

☐ is attached hereto

☐ was filed on _____ as U.S. Application Serial No. _____ (Atty Dkt. No. _____ -)

☒ was filed as PCT International application No. **PCT/GB 00/00882** on **10 MARCH 2000**

and (if applicable to U.S. or PCT application) was amended on _____

I hereby state that I have reviewed and understand the contents of the above identified specification, including the claims, as amended by any amendment referred to above. I acknowledge the duty to disclose information which is material to the patentability of this application in accordance with 37 C.F.R. 1.56. I hereby claim foreign priority benefits under 35 U.S.C. 119/365 of any foreign application(s) for patent or inventor's certificate listed below and have also identified below any foreign application for patent or inventor's certificate having a filing date before that of the application on which priority is claimed or, if no priority is claimed, before the filing date of this application:

Priority Foreign Application(s):

Application Number	Country	Day/Month/Year Filed
9907438.7	GREAT BRITAIN	31 March 1999
99305543.3	EUROPE	13 July 1999

I hereby claim the benefit under 35 U.S.C. §119(e) of any United States provisional application(s) listed below.

Application Number	Date/Month/Year Filed

I hereby claim the benefit under 35 U.S.C. 120/365 of all prior United States and PCT international applications listed above or below and, insofar as the subject matter of each of the claims of this application is not disclosed in such prior applications in the manner provided by the first paragraph of 35 U.S.C. 112, I acknowledge the duty to disclose material information as defined in 37 C.F.R. 1.56 which occurred between the filing date of the prior applications and the national or PCT international filing date of this application:

Prior U.S./PCT Application(s): Application Serial No.	Day/Month/Year Filed	Status: patented pending, abandoned
PCT/GB00/00882	10 MARCH 2000	PENDING

I hereby declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code and that such willful false statements may jeopardize the validity of the application or any patent issued thereon. And on behalf of the owner(s) hereof, I hereby appoint NIXON & VANDERHYE P.C., 1100 North Glebe Rd., 8th Floor, Arlington, VA 22201-4714, telephone number (703) 816-4000 (to whom all communications are to be directed), and the following attorneys thereof (of the same address) individually and collectively owner's/owners' attorneys to prosecute this application and to transact all business in the Patent and Trademark Office connected therewith and with the resulting patent: Arthur R. Crawford, 25327; Larry S. Nixon, 25640; Robert A. Vanderhye, 27076; James T. Hosmer, 30184; Robert W. Faris, 31352; Richard G. Besha, 27770; Mark E. Nusbaum, 32348; Michael J. Keenan, 32106; Bryan H. Davidson, 30251; Stanley C. Spooner, 27393; Leonard C. Mitchard, 29009; Duane M. Byers, 33363; Jeffry H. Nelson, 30481; John R. Lastova, 33149; H. Warren Burnam, Jr. 29366; Thomas E. Byrne, 32205; Mary J. Wilson, 32955; J. Scott Davidson, 33489; Alan M. Kagen, 36178; Robert A. Molan, 29834; B. J. Sadoff, 36663; James D. Berquist, 34776; Updeep S. Gill, 37334; Michael J. Shea, 34725; Donald L. Jackson, 41090; Michelle N. Lester, 32331; Frank P. Presta, 19828; Joseph S. Presta, 35329 I also authorize Nixon & Vanderhye to delete any attorney names/numbers no longer with the firm and to act and rely solely on instructions directly communicated from the person, assignee, attorney, firm, or other organization sending instructions to Nixon & Vanderhye on behalf of the owner(s).

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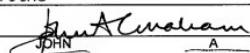
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